

Tuberculosis (TB) Infection Control

I. **TITLE:** Protocol for preventing the transmission of *M. tuberculosis* to uninfected persons.

II. **TYPE OF STANDARD:** Service

III. **OUTCOME:**

1. To ensure that all persons who have or are suspected of having infectious *M. tuberculosis* are identified and promptly placed in AFB isolation and started on appropriate chemotherapy.
2. To ensure that clients remain on appropriate chemotherapy until completion of a recommended course of therapy until cure to prevent a return to infectiousness.
3. To ensure that persons who are not infected with tuberculosis are protected from exposure to infectious *M. tuberculosis* by appropriate precautions wherever there is a potential for TB transmission.

IV. **PERSONNEL:** The following subsections address the classes of personnel who may perform the referenced activities within the constraints of their practice acts and protocols.

1. Responsibility for TB Infection Control Plans: M.D., D.O., A.R.N.P., P.A., or R.N.
2. Triage: M.D., D.O., A.R.N.P., P.A., R.N., L.P.N., and initial contact support staff.
3. Education of Staff: M.D., D.O., A.R.N.P., P.A., R.N., and L.P.N.
4. Cough-inducing and Aerosol-generating Procedures: M.D., D.O., A.R.N.P., P.A., R.N., L.P.N., and H.S.R.
5. Emergency: M.D., D.O., A.R.N.P., P.A., and R.N.
6. Documentation: M.D., D.O., A.R.N.P., P.A., R.N., L.P.N., and H.S.R.

V. **COMPETENCIES:** Health care professionals and para-professionals must have demonstrated knowledge, judgment, and education related to TB infection control and related responsibilities according to the constraints of their individual practice acts and protocols. Professional and para-professional personnel records should contain documentation of training as appropriate for their individual practice acts. This should include didactic, practicum, and clinical training which cover signs and symptoms of TB, pharmacology, clinical studies, identification of client risk, counseling, case management, and complications and side effects of medication. The practitioner may practice independently in each skill area once proficiency is attained in that skill area.

VI. **AREAS OF RESPONSIBILITY:**

Fundamentals of TB Infection Control for County Health Departments (CHDs)

An effective TB control program is based on a hierarchy of infection control measures. These include:

1. **Administrative controls** are the first and most important level of the hierarchy. They are used to reduce the risk of exposing uninfected persons to persons who have infectious TB. These controls include:
 - a.) Developing and implementing effective policies and procedures to ensure the rapid identification, isolation, evaluation, and treatment of persons with signs and symptoms of TB,
 - b.) Implementing effective work practices among health care workers (HCW) in the CHD, including triage of persons who enter the CHD with a prolonged cough,
 - c.) Educating healthcare workers about TB and teaching clients good infection control practices, e.g. using a tissue when coughing,
 - d.) Maintaining an effective employee screening program, which includes respiratory protection and education relevant to TB infection control, and
 - e.) Developing an effective quality improvement program for monitoring on a regular basis the county TB infection control plan.
2. **Engineering controls** are the second level of the hierarchy. Engineering controls are used to prevent the spread and reduce the concentration of infectious droplet nuclei within an area and exhausting the air from that area. They include rooms with adequate negative pressure ventilation, (i.e., a minimum of 6 air changes per hour in existing facilities and 12 per hour for new facilities) and in rooms which re-circulate air through the use of high energy particulate air (HEPA) filters. Appropriate ultraviolet germicidal irradiation (UVGI) may be used in rooms as a supplement to other engineering controls.
3. **Personal respiratory protection** is the third level of the hierarchy. Particulate respirators (PRs) are used when HCWs must share air space with an infectious TB client. These measures are the last line of defense when other more effective measures are not in place or have not had an opportunity to work.

The TB Infection Control Planning Process.

1. Each CHD should have a **TB Infection Control Plan**. This plan is an essential component of the infection control program. The first element of the TB infection control program requires assigning a person or group to be responsible for developing, implementing, and managing the plan. This person or group should include a person or persons with expertise in infection control, occupational health, and engineering controls.
2. The second essential component is preparing a **risk assessment** by the assigned person(s). The infection control plan is based on the risk assessment which determines its content and complexity. It should be based on local conditions including the incidence of TB in the community, the specific groups in which TB most frequently occurs, the rate of drug resistance in the community, the HIV/TB coinfection pattern in the service area, the number or percentage of cases treated at the county health department, and other local circumstances. It should also consider the level of services provided at the CHD. The needs of a CHD in a small county with no reported cases of TB and a small staff will be entirely different from the needs of a CHD serving a large metropolitan area. An effective infection control plan is an ongoing activity. It is recommended that Tuberculosis Information Management System (TIMS) data be reviewed for TB disease patterns over a five year period. Also local TB infection data should be reviewed for trends over a five year period.

- The risk assessment should include all elements discussed in the plan, as applicable to circumstances in the county.
3. The risk assessment should include tuberculin skin testing (TST) health care workers by area, e.g., TB clinic, HIV clinic, or by occupational group for persons not assigned to a specific area, such as clerical staff, laboratory technicians. These health care workers are at a higher risk of exposure to TB than those who may work in other areas of the CHD. However, if there is a common ventilation system throughout the CHD, then all staff would be at the same risk of exposure and TSTs may be required for all staff based on the risk assessment. The person responsible for the infection control plan should review tuberculin skin test results, monitor conversions and clusters at least annually or more often as needed.
 4. The clinic environment where TB services are provided and engineering controls are used to protect clients and staff and should be included in the risk assessment. Data to be considered for the risk assessment includes airflow studies, the operation of the ventilation system, the availability of negative pressure rooms for cough-inducing or aerosol-generating procedures, and, if used, testing and maintenance records of those systems to determine if they are at optimal performance. The functioning and maintenance of supplemental measures such as HEPA filtration and UVGI should also be considered for the risk assessment.
 5. The assigned persons should examine the respiratory protection program. Key features include medical evaluation, respirator selection, fit testing, and documentation of all key features, including return demonstration of fit-testing and fit-checking.
 6. The assigned persons should examine training/education programs for staff. These programs should discuss signs and symptoms of TB, coinfection with HIV, community epidemiology, TB transmission, occupational risk and work practices that reduce the risk of TB, and the TB exposure control plan.
 7. The assigned persons should perform an observational review of TB infection control practices. Examples include ensuring that: (a) symptomatic clients are segregated and evaluated, (b) the TB waiting area is separate from HIV and pediatric waiting areas, (c) high risk procedures are performed in an appropriate environment, and (d) the isolation room airspace is allowed to clear after a high risk procedure is performed or infectious client is seen.
 8. Another element in the risk assessment is assigning the risk category. The risk assessment determines the category assigned to the county health department. Refer to Table 2 in the CDC MMWR, *Guidelines for Preventing the Transmission of Mycobacterium tuberculosis in Health-Care Facilities*, 1994, October 28, 1994/Vol.43/No. RR-13, for a template to determine the content of the TB exposure control plan based on the risk category that has been assigned to the facility. This template is designed for an inpatient setting, however it can be modified to meet the needs of county health departments.
 9. Detailed procedures are needed to address the following issues:
 - Identifying, evaluating, and treating clients who have TB.
 - Managing clients suspected of having active TB disease.
 - Ensuring adequate engineering controls are in place e.g. appropriate air changes, daily monitoring of negative pressure rooms to determine effectiveness. If the room is found to have positive pressure, the room should not be used for infectious TB clients until the air flow problem is corrected.
 - Utilizing National Institute of Occupational Safety and Health (NIOSH) - approved particulate respirators for those who will be entering rooms occupied by

- infectious TB clients. Having an alternative to particulate respirators, such as, e.g. Positive Air Pressure Respirators (PAPR), for those who cannot be fitted (e.g. facial hair) with an N95 or N99 respirator.
- Training each employee involved how cough-inducing and aerosol-generating procedures are to be done.
 - Educating and training health care workers, initially and annually, about TB, including work practices which reduce the likelihood of transmitting TB.
 - Counseling and screening HCWs for TB infection/disease.
 - Investigating HCW TST test conversions and possible nosocomial transmission of *M. tuberculosis*.
 - Reviewing annually the TB infection control plan.
10. All TB infection control protocols and procedures should be physically included in the TB infection control plan.

Note: The following sections provide information that should be incorporated into TB infection control procedures.

VII. TB INFECTION CONTROL GUIDELINES FOR A COUNTY HEALTH DEPARTMENT:

1. **Client Care Guidelines**
 - a. Have infectious or suspected TB clients, if possible, enter the CHD via a separate entrance. Once in the building, place these clients in a separate area apart from other clients, particularly those who are immunocompromised or very young, e.g. infants. Coughing clients should not be kept in open waiting areas with other clients. These clients should be kept outside until they are to be examined or placed in a negative pressure room, if available. The client should also be provided with a surgical mask.
 - b. A negative pressure room is ideal for isolation purposes. If used, a negative pressure room should have at least 6, and preferably, 12 air changes per hour. Each negative pressure room must be certified by the manufacturer and recertified as recommended by the manufacturer or at least annually. The rooms should be monitored daily to assure negative pressure and tested prior to use.
 - c. Guidelines applicable to the individual client should be followed until the client is determined to be non-infectious.
 - d. Avoid scheduling infectious TB clients at the same time as immunocompromised clients, e.g. HIV+ or AIDS or pediatric clients.
 - e. Triage
 - 1) Each client who enters the CHD who has a cough should be promptly evaluated by the triage nurse and, if necessary, placed as quickly as possible, in AFB isolation, e.g. negative pressure room or outside. If a CHD does not have a triage nurse, the initial contact staff persons should have access to, and understand when to use, a cough protocol for symptomatic clients. The cough protocol should include: how long has he or she had this cough? If greater than 3 weeks, the client should be seen immediately by the triage nurse or the TB nurse.
 - 2) The triage nurse must determine if this client is infectious. The following questions should be included in the assessment: (a) signs/symptoms of TB, e.g. bloody sputum, protracted weight loss, loss of appetite, night sweats, persistent low grade fever, (b) past exposure to anyone with these symptoms, (c) history of a positive Mantoux TST, (d) has the person lived or worked with anyone who had TB over the past 2 years, (e) treatment

for active TB - when, where, how long treated, and (f) does the client have any conditions which may weaken the immune system. In addition, the client should be provided with tissues and instructed to use them to cover their mouth and nose when sneezing and coughing to decrease the transmission of potential TB organisms. The client should also be given a surgical mask (the surgical mask prevents the client's secretions from entering the air) to wear and to keep the mask on while the client is in the CHD. The client should be educated about why a mask is necessary. Finally, the client, if determined to be infectious, should be stay in the negative pressure room or outside, if no negative pressure room is available.

3) Clients who have active infectious TB or those who are suspected of having infectious TB disease should not be put in the same waiting area as those who are immunocompromised, e.g. HIV +, or who, if exposed to active infectious TB are more likely to develop TB infection and subsequent TB disease, e.g. infants.

4) "Fast Tracking": A suspected or known infectious TB client in need of a laboratory test, x-ray, or other procedure will be accompanied to another department, e.g. x-ray, and will not be required to wait in waiting areas. Delays can be minimized by communicating with the necessary department prior to the client's arrival.

5) Signs should be placed in waiting areas in various languages advising clients to use tissues to cover their mouths when coughing or sneezing.

2. **Engineering Controls** If a negative pressure room is not available, the following measures may be utilized:

a. HEPA filters

- 1.) These filters should have a documented minimum removal efficiency of 99.97% of particles ≥ 0.3 μ m in diameter.
- 2.) May be installed in exhaust ducts which do not ventilate to the outside.
- 3.) Proper installation and testing and meticulous maintenance are critical if a HEPA filtration system is used, especially if the system used recirculates air to other parts of the county health department.
- 4.) Maintenance of HEPA filters should be provided by trained personnel. A log should be maintained noting the maintenance schedule and any repairs.
- 5.) Appropriate respiratory protection, e.g. NIOSH approved PR, should be worn while performing maintenance.
- 6.) The filter element should not be bumped or dropped during or after removal.

b. Ultraviolet germicidal irradiation (UVGI)

- 1.) UVGI is used as a supplement to other TB infection control measures. It is not a substitute for HEPA filtration or outside exhaustion of air from a negative pressure room.
- 2.) UVGI lamps can be used in ceiling or wall fixtures or within air ducts of ventilation systems (upper air irradiation is preferred).
- 3.) Fixtures must be designed and installed to ensure that UV exposure to persons in the room are below current safe exposure levels.
- 4.) UVGI can cause erythema and keratoconjunctivitis with prolonged exposure. Health care workers and clients should be cautioned to avoid direct exposure.

Do not use UVGI lamps if the lamps are not shielded.

- 5.) Follow manufacturers recommendations for maintenance.
- 6.) UV warning signs, as described in the October 28, 1994 MMWR, Supplement 3, Section E, are required.

3. Cough-inducing and aerosol-generating procedures

These procedures can induce coughing and can increase the likelihood of droplet nuclei being expelled into the air, e.g. collection of sputum, sputum induction, administration of aerosolized medications such as pentamidine, bronchoscopy, endotracheal intubation and suctioning, irrigation of tuberculous abscesses, etc.

- a. These procedures should not be performed on clients who have infectious TB unless it is absolutely necessary and can be performed with appropriate precautions, e.g. adequate air changes and negative pressure room.
- b. The collection of sputum should be performed in a small room or booth with (1) negative pressure relative to the hallways and adjacent rooms and (2) with adequate air changes and air exhausted directly to the outside and away from all windows, doorways, and air supply ducts unless passed through a HEPA filter. This procedure can also be performed outdoors at CHDs which do not have negative pressure rooms and when performed in a home setting.
- d. After completion of the cough-inducing procedure, the client should remain in the negative pressure room or booth until coughing has subsided. The client should be given tissues and instructed to cover their mouth and nose when coughing or sneezing.
- e. Before the booth or room is used for another client, enough time should be allowed to pass for at least 99% of the airborne contaminants to be removed by exhausting to the outside or through HEPA filters. See the October 28, 1994 MMWR, Supplement 3, Table S3-1 for the length of time required to ventilate a room based on air changes per hour.
- f. HCWs should wear NIOSH-approved respiratory protection equipment when present in rooms or booths in which cough-inducing procedures are being performed on clients who have infectious TB or are suspected of having infectious TB.
- g. The negative pressure room/booth must be monitored daily to assure that the flow of air is from the hallway into the negative pressure room. If HEPA filters are used, they must have a regular maintenance schedule.

4. CHD Employees Education/Training/Mantoux TST Screening

a. Education about TB and infection control

Each employee, upon employment and annually, must be provided an education session about TB transmission, symptoms of TB, and the need for Mantoux TST or in the case of a documented positive reactor, a symptom screening questionnaire must be completed.

b. TST Testing

- 1.) As a condition of the HCWs job description, requirement for Mantoux Tuberculin Skin Testing should be included for appropriate CHD employees. Each newly hired CHD employee must be screened for TB infection upon employment utilizing the two-step Mantoux TST method (See TST TA Guideline). A documented Mantoux TST must be provided by previously positive reactors. If documentation is not available, the

Mantoux TST should be repeated.

- 2.) Repeat Mantoux TSTs should be done at least annually for all employees who have a negative reaction.
- 3.) Depending on the CHD's risk assessment, more frequent testing may be indicated, particularly for those working directly in the TB Clinic.
- 4.) Positive HCW reactors should be evaluated annually by using a symptom screening questionnaire which should be signed by the employee and placed in their file.
- 5.) All new positive reactors must receive an initial chest x-ray, and an evaluation by a clinician, if the employee is asymptomatic. Symptom questionnaires should be used annually. Further chest x-rays are not required unless the client is exhibiting symptoms of TB disease, e.g., productive cough, hemoptysis.
- 6.) All new positive reactors with a negative chest x-ray must be evaluated for treatment for LTBI.

5. **Respiratory Protection Program**

a. Personal Respirators (PRs)

PRs should be used by:

- 1.) HCWs who enter negative pressure rooms where clients with known or suspected infectious TB are placed,
 - 2.) HCWs present during cough-inducing or aerosol-generating procedures, or
 - 3.) HCWs in other settings where administrative and engineering controls are not likely to protect them from inhaling infectious airborne droplet nuclei, e.g. those who transport clients.
- b. The particulate respirators recommended by NIOSH for protection against TB are the N-95, N-99, or N-100.
- c. Each HCW who is to wear a PR and his/her supervisor must receive training about the necessity of wearing a PR and the potential risks associated with not wearing it. This training should also include:
- 1.) The nature, extent, and specific hazards for *M. tuberculosis* transmission in the CHD,
 - 2.) A description of specific risks for TB infection among persons exposed to *M. tuberculosis*, of any subsequent treatment with INH or other treatment for latent tuberculosis infection regimens, and of the possibility of active TB disease,
 - 3.) A description of engineering controls and work practices and the reasons why they do not eliminate the need for personal respiratory protection,
 - 4.) An explanation for selecting a particular type of respirator, how the respirator is properly maintained and stored, and the operation, capabilities, and limitations of the respirator provided,
 - 5.) Instruction in how the HCW wearing the respirator should inspect, put on, fit check, and correctly wear the provided respirator,
 - 6.) An opportunity to handle the respirator and learn how to put it on, wear it properly, and check the important parts, and
 - 7.) Instruction in how to recognize an inadequately functioning respirator.

- d. PRs should be available in at least 3 sizes to fit different facial sizes and characteristics of HCWs.
- e. HCWs must check their PR for the proper fit each time it is worn and before entering the infectious client's room.
- f. PRs may be reused unless they become physically damaged or soiled.
- g. Keep PRs which are to be reused, clean and dry between uses.
- h. Evaluate the personal respiratory protection program at least once a year.
- i. An alternative (e.g. PAPR) should be available for those HCWs who can not be adequately fitted (e.g. those with facial hair).

VIII. INFECTION CONTROL GUIDELINES FOR SPECIFIC SITUATIONS OUTSIDE THE CHD:

- 1. Returning home from the hospital
 - a. If a client is admitted to a hospital, there is no minimum number of days of anti-TB treatment that is required before a client may be discharged from the hospital.
 - b. A smear positive client who is currently receiving appropriate treatment and is adherent to the treatment regimen may be discharged to home, if the following conditions are met:
 - 1.) Lives alone or in a household with immunocompetent people who have already been previously exposed,
 - 2.) Will cover his/her nose and mouth with a disposable tissue when coughing or sneezing,
 - 3.) Has no contact with infants, young children, or immunosuppressed persons.
 - c. A smear positive client should not be discharged to any of the following situations:
 - 1.) A congregate living facility, e.g. homeless shelter, nursing home, jail, prison, group home, etc,
 - 2.) A living situation where infants and young children reside, or
 - 3.) A living situation where immunosuppressed people reside, e.g. HIV infected persons, persons taking chemotherapy for cancer, persons on prolonged steroid treatment.
 - d. If a client in a hospital cannot be discharged back to the original place of residence, alternative measures (e.g. appropriate motels) should be considered (consult with the Bureau of TB and Refugee Health at (850) 245-4350/SC205-4350).

- 2. Guidelines for Clients Treated at Home

Most persons in the home have already been exposed during the client's most infectious period, before treatment began. The following guidelines should be explained to the client and/or family to prevent further exposure to uninfected family members or visitors:

 - a. Discuss airborne nature of TB,
 - b. Teach the client to cover his/her mouth and nose with disposable tissues when coughing or sneezing,
 - c. Ensure that previously-unexposed persons not be allowed to visit during the infectious period, especially infants, children and immunosuppressed persons.,
 - d. Stress the importance of taking TB medications as prescribed to reduce infectiousness,
 - e. Advise that special ventilation is not needed in the home.

- f. Ensure that sputum collection at home is to be done outside unless there is a well-ventilated area within the home.

3. Returning to normal activities

In general, when a client is smear negative for sputum specimens collected on 3 consecutive days and has been on adequate medications for at least 2 weeks and has shown clinical improvement (e.g., weight gain, decreased coughing, decreased fever), he/she is considered to have a low risk of transmission and can return to normal activities.

a. Return to work outdoors

1.) If sputum smears are negative, the client has started on TB medications, and the client does not work closely with other people, he/she may return to work as soon as they are physically able,

2.) Drug susceptibility results should be known. However, the results are generally not known this early. Therefore, the client does not necessarily have to wait if he/she is on adequate therapy and clinically responding.

b. Return to work/school/other indoor activities

1.) If the client is on directly observed therapy (DOT) or adherence to the medication regimen is assured and drug resistance is not suspected, the client may return to work, when:

(a.) Symptoms have improved in response to treatment, such as decreased coughing,

(b.) Smear positive client has 3 negative smears collected on 3 separate days, and

(c.) Drug susceptibility results are known. However, the results are generally not known this early. Therefore, the client does not necessarily have to wait if he/she is on adequate therapy and clinically responding.

2.) If the client has drug resistant TB, the client must be on DOT, must have 3 negative smears collected on 3 consecutive days, and clinically responding to treatment.

3.) Frequent monitoring of sputum specimens combined with DOT should be considered for all clients until completion of therapy. It is especially important for clients who work in health care settings, schools, day care centers, prisons/jails, etc.

IX. REFERENCES:

MMWR, September 8, 1995/Vol. 44/No. RR-11. Essential Components of a Tuberculosis Prevention and Control Program.

MMWR, October 28, 1994/Vol. 43/No. RR-13. Guidelines for Preventing the Transmission of *Mycobacterium tuberculosis* in Health-Care Facilities, 1994.

New York City Department of Health. Clinical Policies and Protocols - Infection Control.

U.S. Department of Health and Human Services. NIOSH Guide to the Selection and Use of Particulate Respirators. 1996.

NTNCC. Tuberculosis Nursing: A Comprehensive Guide To Patient Care. 1997.

Francis J. Curry National Tuberculosis Center, Institutional Consultation Services. *Isolation Rooms: Design, Assessment, and Upgrade*, 1999.